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ACQUISITION  
OF CHEMICAL EQUIPMENT AND TECHNOLOGY  
BY THE SOVIET BLOC FROM THE FREE WORLD  
1957 THROUGH MID-1963



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FOREWORD

For this report, attempts have been made to determine the number, kind, and value of chemical installations and related technology purchased by the Soviet Bloc from the Free World during 1957 through mid-1963; to assess the significance of these purchases to the development of the chemical industries of the Bloc; to highlight some of the problems experienced by the Bloc in putting the installations into full production; and to estimate the trend and probable value of such purchases during the period 1964-70.

The value figures given throughout for purchases by the Soviet Bloc of installations from the Free World refer to the contract values, which include values not only for the equipment but also for services and, in many cases, for related technology. The dollar values, which are given in terms of current US dollars, were derived partly from Western European currency values converted at the official rates of exchange. Because contracts may be carried out during a period of years, the contracts concluded are not precisely comparable with the officially reported imports of chemical equipment by the Bloc in any given year.

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ACQUISITION OF CHEMICAL EQUIPMENT AND TECHNOLOGY  
BY THE SOVIET BLOC FROM THE FREE WORLD\*  
1957 THROUGH MID-1963

Summary and Conclusions

Throughout the Soviet Bloc the effort to accelerate the growth of chemical production in support of agriculture, industry, and the consumer is being assisted significantly by purchases of chemical plants and technology from the Free World. During 1957 through mid-1963 the Bloc contracted for 234 chemical installations with an estimated value of nearly \$1.3 billion.\*\* The USSR was the major purchaser, concluding contracts valued at about \$900 million, equal to almost three-fourths of the value of all installations acquired. Among the Eastern European countries, Rumania was by far the leading buyer. The most important countries supplying chemical plants to the Bloc were the UK, West Germany, Italy, and France.

The contribution of the installations supplied by the Free World to the development of the chemical industries of the Soviet Bloc clearly will be substantial. Of the 234 installations purchased during 1957 through mid-1963, about 150 to 200, with an estimated value of almost \$1 billion, probably will be in operation by 1965. These installations are expected eventually to make significant contributions to production by the Bloc of chemical fibers, basic petrochemicals, plastics, agricultural chemicals, rubber, rubber products, and other chemicals, and, in turn, to the growth of output in other sectors of the economy. Moreover, the significance of the purchases probably is greater than that suggested by their dollar value because the installations from the Free World incorporate much new technology which could be developed in the Bloc only at the expense of other high-priority programs. In the short run, however -- because of the inexperience and incompetence of planning, construction, engineering, and operating personnel -- the countries of the Bloc will experience difficulties in obtaining maximum production from the installations from the Free World.

Barring a major change in the present order of their investment priorities, the countries of the Soviet Bloc in the next few years probably will increase their purchases of chemical installations from the Free World. Thus, during 1964-70, purchases can be expected to

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\* The estimates and conclusions in this report represent the best judgment of this Office as of 1 March 1964. The terms Soviet Bloc and Bloc as used throughout this report include the USSR and the Eastern European countries (Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Rumania, and Albania). Although Albania did not purchase any plants or equipment from the Free World, negotiations were carried out by Albania with suppliers in the Free World during 1963.

\*\* The minimum known value of these contracts is \$989.6 million.

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exceed the \$1.3 billion spent during 1957 through mid-1963 and, in the light of present trends, could go as high as \$2 billion to \$3 billion if credit and terms of payment acceptable to the Bloc can be arranged with the supplying countries.

This view is reinforced by the new Soviet program for the chemical industry during 1964-70, announced at the Plenum of the Central Committee of the Communist Party of the Soviet Union held in December 1963. The data on planned investment given at the Plenum, together with an assessment of the capabilities of the USSR and the Eastern European countries for production of chemical equipment, suggest that considerable equipment will be required from the Free World to execute the new Soviet chemical program. The cost to the USSR of importing this amount of equipment and the associated technology and services from the Free World during 1964-70 may run as high as \$2 billion.

If, as presently indicated, efforts of the Eastern European countries to procure chemical installations from the Free World also are accelerated, the value of such purchases during 1964-70 can be expected to exceed the \$366 million of purchases during 1957 through mid-1963, and it could reach \$0.5 billion to \$1 billion.

Problems, however, could arise that would tend to depress the level of such purchases below that estimated. Perhaps most likely to hamper the buying program are the usual problems associated with concluding contracts. Negotiating contract prices, credit, terms of payment, delivery dates, installation services, and many other matters to the mutual satisfaction of the parties could prolong the individual contract negotiations and prevent the over-all rate of purchasing from rising substantially. Another problem, the dimensions of which are not yet clear, is related to the control of technology. Presumably the countries of the Soviet Bloc will try to purchase from the Free World much petrochemical technology and equipment, some of which may be under the proprietary control of US firms. To the extent that this proves to be the case, US export controls on petrochemical technology, unless relaxed, would exert a damping effect on the purchasing efforts of the Bloc.

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## I. Background

During the past several years the continuing interest of the Soviet Bloc in purchasing advanced chemical processes and equipment from the Free World reflects both the relative backwardness of the chemical industries of the Bloc and a growing recognition by the Bloc of the vital importance of a large chemical industry in a modern economy. Even without the many essential uses of chemical products in modern weaponry, ample justification exists for this current Bloc interest. The chemical industry has potential for providing a wide assortment of consumer goods manufactured from synthetic fibers, plastics, and rubber; numerous chemicals are required as processing aids and intermediate materials in industries producing metals, petroleum products, construction materials, pharmaceuticals, and other products; and a more productive agriculture is possible through the increased use of chemical fertilizers, pesticides, and feed supplements.

The long-range intention throughout the Soviet Bloc to expand the chemical industry is particularly apparent in the USSR. Premier Khrushchev himself is perhaps the Bloc's most enthusiastic advocate of rapid chemical development, which he visualizes as a major means of attaining his stated objectives of increasing productivity in agriculture and industry and of providing the population with consumer goods of a quality and assortment comparing favorably with products available in the Free World. In mid-1958, at a special Plenum of the Central Committee of the Communist Party of the Soviet Union concerning development of the chemical industry, Khrushchev, in a major policy speech, exposed the shortcomings of the Soviet chemical industry and outlined a program for rapid development of the industry during 1959-65. The central theme of the speech concerned the elimination of lags in production of synthetic materials (plastics, fibers, and rubber). To facilitate rapid growth in production of these products, Khrushchev called for a shift of the raw material base of the industry from agricultural products and coal to the relatively less costly petroleum and natural gas and for the adoption of modern, automated processes to replace outmoded and labor-consuming operations. The Soviet leader declared further that, to save the time normally required for development of new processes and equipment, the procurement of part of the necessary equipment from "capitalist" countries would be expedient. An ambitious goal to triple output of chemicals during 1959-65 was then set, and a capital investment of 10 billion to 10.5 billion rubles was scheduled.\* 1/\*\*

\* Ruble values are given in new rubles throughout this report. A nominal rate of exchange based on the gold content of the respective currencies is 0.90 ruble to US \$1. The appropriate ruble-dollar ratio to be used in this report is unknown. However, the quantity of domestic resources that the USSR would have to invest to accomplish these tasks amounts to the equivalent of much more than the values derived by the official rate of exchange.

\*\* For serially numbered source references, see Appendix B.



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The Soviet effort to expand the chemical industry of the USSR had repercussions in the Eastern European countries. These countries had reconstructed war-damaged facilities and were gradually enlarging the scope of their domestic chemical industries, in large part with direct aid in the form of equipment and technology through credits from the USSR. After 1958, however, taking their cue from Khrushchev, officials of the Eastern European countries turned increasingly to countries of the Free World for purchases of plants and technology.

The results of the Soviet program for chemicals, some 5 years after its inception, have not been very satisfactory. In spite of a relatively high rate of growth, the goal of tripling output by 1965 is far behind schedule. Part of this failure is attributable to a lagging chemical equipment industry. During 1959-62, investment in the Soviet chemical equipment industry totaled only 100 million rubles, apparently far out of line in comparison with an investment of about 3.8 billion rubles in the chemical industry. <sup>2/</sup> Although production of chemical equipment more than doubled during 1959-62, both the desired quantity and the assortment required have been far behind plan. The shortage of chemical equipment has been further aggravated by the provision of much defective equipment, which has necessitated costly redesign or repair and has prevented many plants from operating at planned capacity. Furthermore, the inadequate development of advanced chemical processes, particularly in the fields of synthetic materials and petrochemicals, has impeded the development of chemical industries throughout the Soviet Bloc.

Viewed in the light of the domestic shortcomings in development of chemical equipment and associated technology, the purchases by the Soviet Bloc from the Free World are easily understood. Chemical processes are thus acquired with less delay, expense, and diversion of scientific and engineering talent than would be needed for domestic development. With the superior Free World processes, in turn, the Bloc potentially can lower costs of production and improve the quality of chemical end products. In addition, the supplying of chemical equipment appears on the whole to be carried out more expeditiously by Free World firms than by domestic organizations, and the imported equipment is often of superior design and quality.

## II. Purchases of Equipment and Technology

Following the Soviet decision in late 1956 to realign priorities for industrial investment in favor of the materials industries, the USSR and the Eastern European countries began to look to the Free World for help in developing their chemical industries. The program for the purchase of complete chemical plants and large components of such plants started slowly with a few modest contracts in 1957 but, after receiving Khrushchev's blessing in May 1958, accelerated rapidly, and during 1959 more than 30 contracts with a total estimated value of \$285 million were signed. During 1960-62, purchasing remained at

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a high level, exceeding an estimated value of \$200 million annually, and in the first 6 months of 1963 it reached a half-year peak of an estimated value of \$190 million. For the entire period during 1957 through mid-1963, the contracts concluded with firms in the Free World called for the delivery of 234 chemical plants and major items of chemical equipment with an estimated value of about \$1.3 billion.

Within the Soviet Bloc the number and value of chemical plants and equipment purchased have varied considerably from country to country. By mid-1963, the USSR had contracted for 120 chemical installations valued at about \$900 million,\* equal to 51 percent of the number and 71 percent of the estimated value of all chemical plants and components ordered. Among the Eastern European countries, differences in capability to manufacture equipment domestically and in potential for developing the chemical industry presumably have been the main factors affecting the degree of activity in purchasing plants and equipment from sources in the Free World. East Germany, which in 1957 already had one of the large chemical industries in the world and a considerable domestic capacity for producing equipment, has purchased comparatively few plants from countries of the Free World. Rumania, in contrast to East Germany, has a small chemical industry and a low scale of domestic production of equipment but possesses plentiful supplies of chemical raw materials. Thus it has a high potential for chemical production. During 1957 through mid-1963, Rumanian purchases of plants and equipment amounted to 57 percent by value of the total purchases of the Eastern European countries and 16 percent of the total of the Bloc. The estimated value of chemical equipment and technology contracted for by the Bloc from the Free World is given in Table 1.\*\*

Four Western European countries (the UK, West Germany, Italy, and France) have supplied the bulk of the equipment purchased by the Soviet Bloc. These Western countries have been ready to grant credit, and in general they can produce the type and quality of plants desired in the Soviet Bloc. From the beginning of 1957 on, each of the four has contracted to deliver at least a minimum of 30 plants, with each country receiving contracts for at least \$100 million. The UK and West Germany, the largest suppliers, together have sold at least 126 plants or components with a known minimum value of \$563 million, or about 57 percent by value of all the transactions involved. Belgium, also a significant supplier, has sold 19 plants with a known minimum value of \$63 million. Outside Western Europe, only the US and Japan have built chemical equipment for the Bloc. Japan has sold oxygen plants to the USSR, and about two-thirds of the value of sales by the US consist of two contracts with Rumania. 3/ The known minimum value

\* According to official trade statistics, the total value of equipment supplied by the Free World for the Soviet chemical industry and actually paid for in 1958-62 amounted to nearly \$440 million.

\*\* P. 6, below.

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Table 1

Estimated Value of Chemical Equipment and Technology  
Contracted for by the Soviet Bloc from the Free World  
1957 Through Mid-1963

Country <u>a/</u>	Estimated Value <u>b/</u> (Million Current US \$)	Plants and Components (Units)
Bulgaria	2	1
Czechoslovakia	31	13
East Germany	31	10
Hungary	25	14
Poland	67	23
Rumania	210	53
Total Eastern European countries	<u>366</u>	<u>114</u>
USSR	<u>900</u>	<u>120</u>
Total	<u>1,266</u>	<u>234</u>

- a. No chemical equipment or technology was contracted for by Albania.  
b. Estimated values are based on known values from Table 3 (p. 8, below), which range from 0 percent for Bulgaria to 92 percent of the total estimated value for Hungary. The Bulgarian value was based on the purchase of a similar plant by the USSR.

of chemical equipment and technology contracted for by the Bloc from the Free World is given in Table 2.

The types of plants purchased by the Soviet Bloc are mainly those that produce the modern synthetic products which are in great demand in the Bloc. Plants for production of chemical fibers and their intermediates have been the most important. Purchases in this category during 1957 through mid-1963 totaled 58 plants with a known minimum value of about \$343 million, more than one-third of the total known value of all known purchases of chemical plants and equipment from the Free World in this period. Next in order of importance have been plants for production of basic petrochemicals (\$188 million), plastics and their intermediates (\$144 million), agricultural chemicals (\$132 million), rubber and rubber products (\$110 million), and other chemicals (\$72 million). Types of chemical equipment and technology contracted for by the Bloc from the Free World are given in Table 3.\*

\* P. 8, below.

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Table 2

Known Value of Chemical Equipment and Technology  
Contracted for by the Soviet Bloc from the Free World a/  
1957 Through Mid-1963

<u>Country</u>	<u>Known Minimum Value</u>		<u>Plants and Components</u>	
	<u>Million Current US \$</u>	<u>Percent of Total</u>	<u>Units</u>	<u>Percent of Total</u>
UK	352.7	35.6	57	24.4
West Germany	210.7	21.3	69	29.5
Italy	146.9	14.8	35	15.0
France	103.6	10.5	29	12.4
Belgium	63.2	6.4	19	8.1
Finland	32.6	3.3	2	0.9
US	31.9	3.2	7	3.0
Netherlands	25.5	2.6	5	2.1
Japan	14.0	1.4	6	2.6
Switzerland	6.0	0.6	1	0.4
Austria	1.5	0.2	1	0.4
Sweden	1.0	0.1	3	1.3
Total	<u>989.6</u>	<u>100.0</u>	<u>234</u>	<u>100.0</u>

a. Because of subcontracting and because the values of some plants and equipment either are unknown or are not directly attributable to one country, the known minimum values and the number of plants and components cannot be directly associated in every case. These values and numbers, therefore, are general parameters indicating approximate but fairly exact levels. Because of rounding, components may not add to the totals shown.

With the data available at present a reliable measure cannot be given for the over-all significance of this equipment-purchasing program to the development of the chemical industries of the Soviet Bloc. Clearly, however, the contribution of the installations supplied by the Free World will be substantial. Of the 234 chemical installations purchased during 1957 through mid-1963, about 150 to 200, valued at almost \$1 billion, probably will be in operation by 1965. The significance of these purchases to the economies of the Bloc probably is greater than suggested by their dollar value because many of the Free World installations embody new technology and equipment, the reproduction of which could be accomplished domestically only by diverting scarce resources, especially scientific and engineering talent, from other high-priority programs, such as those for advanced weapons systems and space.

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Table 3

Types of Chemical Equipment and Technology  
Contracted for by the Soviet Bloc from the Free World a/  
1957 Through Mid-1963

Country <u>b/</u>	Chemical Fiber and Intermediates		Basic Petrochemicals		Plastics and Intermediates		Agricultural Chemicals		Rubber and Rubber Products		Other Chemicals	
	Units	Known Minimum Value (Million Current US \$)	Units	Known Minimum Value (Million Current US \$)	Units	Known Minimum Value (Million Current US \$)	Units	Known Minimum Value (Million Current US \$)	Units	Known Minimum Value (Million Current US \$)	Units	Known Minimum Value (Million Current US \$)
Bulgaria	0	0	0	0	0	0	0	0	0	0	1	N.A.
Czechoslovakia	3	3.4	4	8.4	1	6.3	0	0	2	3.1	3	N.A.
East Germany	0	0	3	18.6	4	5.8	0	0	3	4.5	0	0
Hungary	1	5.0	2	3.7	2	2.0	1	3.8	1	5.3	7	3.2
Poland	4	18.0	4	10.9	3	7.3	1	3.5	1	N.A.	10	6.6
Rumania	13	56.8	14	52.3	4	8.4	6	5.4	6	23.7	10	3.0
Total Eastern European countries	21	83.2	27	93.2	14	29.8	8	12.7	13	36.6	31	12.8
USSR	37	260.1	15	94.2	20	114.7	15	119.3	6	72.2	27	59.4
Total Bloc	58	343.3	42	188.1	34	144.5	23	132.0	19	109.5	58	72.2

a. Because of subcontracting and because the values of some plants and equipment either are unknown or are not directly attributable to one country, the known minimum values and number of plants and components cannot be directly associated in every case. These values and numbers, therefore, are general parameters indicating approximate but fairly exact levels.

b. No chemical equipment or technology was contracted for by Albania.

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III. Purchases of Equipment and Technology, by Major Type, and the Significance to Output Planned by the Soviet Bloc

A. Chemical Fibers and Intermediates

The sector of the chemical industry of the Soviet Bloc in which purchases of installations from the Free World were of greatest value during 1957 through mid-1963 was that of chemical fibers and intermediates. Contracts were signed for 58 installations having a known minimum value of \$343 million. These acquisitions constituted about one-fourth of the number and more than one-third of the known value of all types of units obtained during this period. Purchases include plants for such fibers as nylon-6, orlon, dacron, rayon, and cellulose acetate and for such intermediates as caprolactam, hydrogen cyanide, dimethyl terephthalate, acetic anhydride, and cellulose.\*

The acquisition of these plants will play an important part in the fulfillment of plans of the Soviet Bloc for increasing the output of chemical fibers. For the USSR alone, the combined capacity of chemical fiber plants purchased from the Free World exceeds 100,000 tons annually,\*\* equal to about one-fourth of the goal (444,000 tons) planned for output of chemical fibers in 1965. More significantly, these plants from the Free World, most of which will be operating in 1965, will have the capacity to provide about 40 percent of the increase planned for production in 1965 (278,000 tons more than production in 1958). In Rumania, which accounts for about two-thirds of both known value and number of the acquisitions of chemical fiber plants by the Eastern European countries, all of the synthetic fiber and most of the rayon output in 1965 will be produced in facilities acquired from the Free World. Poland also plans to produce its entire output of dacron and orlon in 1965 in plants from the Free World, and installations purchased by Czechoslovakia for production of nylon-6 and dacron and by Hungary for production of nylon-6 apparently are essential for meeting their goals for synthetic fibers in 1965.

To increase both quality and output of tires, several countries of the Soviet Bloc have purchased installations from the Free World for production of tire cord from chemical fibers. All of these Communist countries except Albania manufacture motor vehicle tires, and all have production problems because of the low quality and quantity of tire cord available for use. The USSR has contracted for three plants to produce cellulose suitable for rayon tire cord, two plants for rayon tire cord, and two plants for nylon tire cord. In the case of Rumania, which purchased a cellulose plant for rayon tire cord and one plant each for rayon and nylon tire cord, all

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\* For a list of selected contracts for the purchase of chemical equipment and technology by the Soviet Bloc from the Free World, see Tables 4 through 10 (pp. 20 through 43) in Appendix A.

\*\* Tonnages are given in metric tons throughout this report.

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production of tire cord will be from plants obtained in the Free World. All of the present output of nylon tire cord in Czechoslovakia similarly comes from a plant purchased in Western Europe.

#### B. Basic Petrochemicals

Purchases by the Soviet Bloc of installations for production of petrochemicals (42 installations at a known minimum value of \$188 million) are second only to those for production of chemical fibers and comprise 18 percent and 19 percent of the number and known value, respectively, of all chemical plants and components obtained from countries of the Free World. During 1957 through mid-1963, the Eastern European countries acquired more petrochemical installations from the Free World than did the USSR, although the Eastern European purchases, by known value, were somewhat lower than those of the USSR. Rumania purchased more than half of the total acquisitions by the Eastern European countries. The majority of plants obtained by the USSR and the Eastern European countries are for production of ammonia, acetylene, and ethylene.

The interest in purchasing petrochemical equipment from the Free World reflects the strong emphasis throughout the Soviet Bloc on the development of facilities to process petroleum and natural gas as chemical raw materials. The use of petroleum and natural gas rather than coal and agricultural products is expected to result in a more efficient raw material base, especially for such important sectors of the chemical industry as plastics, chemical fibers, rubber, and fertilizer. By 1965 the consumption of petroleum and natural gas as raw materials by the chemical industry of the USSR is to increase to a level of 5.6 times that for 1958. Rumania is making a belated effort to utilize abundant domestic deposits of petroleum and natural gas in the chemical industry, and other Eastern European countries have important projects underway for the development of facilities to process petroleum from the USSR.

Plants and components obtained from countries of the Free World will constitute an important part of the capacity required to meet goals for production of petrochemicals in the USSR in 1965. Plants supplied by the Free World could produce about 600,000 tons of ammonia in 1965. Approximately one-third or more of Soviet output of acetylene and at least one-fifth of the ethylene produced in 1965 will be in plants acquired from the Free World.

The Eastern European countries apparently will depend even more on plants acquired from the Free World to meet 1965 goals for production of petrochemicals than will the USSR. Rumania plans to increase production of chemicals from natural gas 14 times and from petroleum 37 times by 1965 in comparison with 1959, 4/ and the major facilities required for this increase are to be plants obtained from the Free World. The most notable Free World units in Rumania are the petrochemical complexes at Brazi and Craiova. 5/ Hungary has

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acquired installations from the Free World to expand its largest existing chemical combine, which is to shift from coal to natural gas as a raw material, 6/ and Czechoslovakia and Poland, which derive much of their present chemical output from coal, plan to begin production of ammonia from natural gas with equipment purchased in the Free World. In some Eastern European countries, production of certain petrochemical materials -- for example, ethylene, which is used in the manufacture of plastics -- may take place entirely with equipment supplied by the Free World.

C. Plastics and Intermediates

During 1957 through mid-1963, purchases of plants and equipment for production and processing of plastics and intermediates were especially important. Contracts were signed for the purchase of 34 installations at a known cost of \$144 million.\* About half of these installations were for production of polyethylene. Two polyethylene plants having a combined annual capacity of 48,000 tons were purchased by the USSR and are already in operation. Contracts for eight additional plants having an annual combined capacity of 192,000 tons also have been signed by the USSR. 7/ In an unusual instance in 1961, Czechoslovakia, East Germany, Poland, and Rumania signed a joint contract for the purchase of one polyethylene plant each from a UK firm. 8/ In addition, the Soviet Bloc has acquired installations for production of such important plastics intermediates as formaldehyde, phthalic anhydride, and maleic anhydride.

Plants acquired from the Free World are essential for the accomplishment of goals throughout the Soviet Bloc for greatly increasing the output of plastics. The USSR has contracted for 20 plants to produce plastics and their intermediate chemicals at a known cost for 13 of the plants of about \$115 million. Of these 20 plants purchased, 17 are producing or will be producing basic plastics materials. The combined annual capacity of all these plants is about 300,000 tons. The purchased capacity that will operate in the USSR in 1965 is estimated at about 90,000 tons -- almost 10 percent of the goal planned (950,000 tons) for production in 1965 and about 13 percent of the increment (690,000 tons) by which production in 1965 is planned to be above production in 1958. About four-fifths of all the plastics capacity sold to the USSR by firms in the Free World has been for production of polyethylene. About a third of planned production of all plastics in Rumania; almost 100 percent of output of polyethylene of East Germany, Poland, Czechoslovakia, and Rumania; and all output of polystyrene in Poland and Rumania will be produced in 1965 in plants purchased from the Free World.

\* The cost of 22 installations. Cost data for the other 12 installations are not available.



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Because of the adaptability of plastics to a wide variety of industrial uses, the acquisition of plants and equipment for the processing of plastics has become increasingly important in the Soviet Bloc. Both East Germany and the USSR have purchased equipment for this purpose from Free World countries. Equipment purchased by the USSR is designed to process polyethylene and polyvinyl chloride into plastic pipes and fittings. Such purchases probably will increase inasmuch as plastics are planned to be substituted widely for metals and lumber in both heavy and light industry throughout the Bloc. Rumania, for example, plans to use at least 30 percent of the total output of plastics to replace metals and 20 percent to replace wood in 1965.

#### D. Agricultural Chemicals

In view of the concern shown throughout the Soviet Bloc for improvement of agriculture, the purchase during 1957 through mid-1963 of plants for production of chemical fertilizers and pesticides was not surprising. Soviet purchases (15 installations with a known minimum value of at least \$119 million) amounted to 65 percent of the number and about 90 percent of the known value of such installations acquired by the Bloc. Moreover, the priority assigned to production of fertilizer in the USSR in 1963 may well result in increased efforts by the USSR to obtain fertilizer plants and supporting installations from non-Bloc countries. By mid-1963, Soviet purchases included equipment for production of urea (a concentrated nitrogen fertilizer), phosphoric acid (for double superphosphate fertilizer), ammonium nitrate, and herbicides. Rumania, which contracted for six of the eight units to be obtained by the Eastern European countries, purchased, in with other equipment, a compound fertilizer plant, two phosphoric acid plants, and equipment for a phosphorus fertilizer plant. These installations could produce more than half of the output of phosphorus fertilizers planned by Rumania for 1965. The two units acquired by the other Eastern European countries were urea plants obtained by Poland and Hungary. In addition, the Bloc purchased plants for production of ammonia and nitric acid, most of which is used in the manufacture of nitrogen fertilizers, and sulfuric acid, a large part of which is consumed in the production of superphosphate fertilizer.

Plants purchased from countries of the Free World constitute a major part of the capacity in the Soviet Bloc for production of urea, a commodity usable as a fertilizer and a feed supplement. Four large urea plants acquired by the USSR could produce almost 40 percent of the planned Soviet output of 1.6 million tons in 1965.\* 9/ The bulk of capacity for production of urea in Rumania, Hungary, and Poland

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\* The contribution of the Free World may be even greater than 40 percent of the total Soviet output, inasmuch as the USSR also has contracted for part of the equipment for other urea plants, but the expected dates of operation of these plants are not available.

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consists of plants purchased from the Free World, and the output of these plants will amount to a significant part of production of nitrogen fertilizer planned for 1965.

#### E. Rubber and Rubber Products

All countries of the Soviet Bloc except Bulgaria and Albania have contracted to obtain installations from the Free World for the rubber and rubber products sector of the chemical industry. During 1957 through mid-1963, contracts were signed for the purchase of 19 such installations with a value of at least \$110 million. Acquisitions by the Eastern European countries, consisting mainly of tire plants and components, constitute about 70 percent of the number of installations for rubber and rubber goods purchased by the Bloc. Soviet purchases, however, were for installations of larger capacity and thus are of higher value than the plants purchased by the countries.

Purchases of equipment from the Free World will affect to a considerable degree the accomplishment of long-range goals for production of rubber and rubber goods. An increased output of rubber products, especially tires, is planned throughout the Soviet Bloc, and all countries except Albania have begun or plan to begin production of synthetic rubber. The USSR signed contracts for equipment to produce synthetic rubber, for one tire plant with a capacity for production of 2 million tires (14 percent of the increase planned for 1959-65), and for major components for two other tire plants with combined projected capacities of 3.3 million tires. Rumania purchased a complete tire plant, now in operation, which has a capacity almost equal to the 1965 goal for production of tires. 10/ In addition, Rumania purchased equipment for a previously existing tire plant, for two rubber products plants, and for a synthetic rubber plant. Polish, East German, and Hungarian purchases of tire-manufacturing equipment also will facilitate the achievement of their 1965 goals for production of tires.

#### F. Other Chemicals

A wide variety of installations for production of miscellaneous chemical commodities, such as acids, alkalis, industrial gases, and detergents, also was purchased by the Soviet Bloc from the Free World during 1957 through mid-1963. Of the total number of such acquisitions, slightly more than half were acquired by the Eastern European countries and in particular by the ones having relatively little domestic capability for production of chemical equipment. For these countries, the plants purchased constitute an important part of the capacity required to accomplish planned production of chemicals. In 1965, for example, output of all acetylene for chemical purposes in Bulgaria, about half of the sulfuric acid in Rumania, more than half of the chlorine in Hungary, and about 8 percent of the sulfuric acid in Poland are to be produced in installations acquired from the Free World.

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#### IV. Problems of the Soviet Bloc with Chemical Equipment and Technology from the Free World

Although the purchase of chemical plants and equipment from the Free World will make a significant contribution to performance of the chemical industries of the Soviet Bloc, optimum results clearly are not being achieved. Many of the potential advantages have been at least partly offset by serious and continuing problems resulting largely from poor planning by the countries of the Bloc concerned and from the inexperience and incompetence of local construction, technical, and operating personnel. These problems are found throughout all phases of the projects from the initial ordering through the construction and final testing and operating of the plants.

##### A. Problems of Ordering and Construction

Indecision frequently has characterized negotiations for chemical plants and equipment conducted by countries of the Soviet Bloc and, as a result, allocations of contracts to specific bidders often have been unreasonably delayed. For example, after contacting firms in the US, France, West Germany, Italy, and the UK for a large tire plant, Rumania took from 1957 to 1959 to reach a decision even though, according to the UK firm involved, only 6 months were necessary to prepare surveys and bids. 11/ Some of the indecision and delay may be due to temporary problems of payment or to efforts to obtain more favorable credit terms, but simple bureaucratic inefficiency also must be held responsible.

Throughout the Soviet Bloc, but especially in the USSR, the caliber of preliminary planning and preparations for installation of imported equipment frequently has been very poor. A host of necessary preparations are the responsibility of the receiving country and include planning for and providing utilities, buildings, storage, transportation, and delivery of construction materials as well as arrangements for personnel to install, operate, and maintain the equipment. As early as 1959, Khrushchev complained of the "criminal attitude" of planning organizations whose incompetence resulted in tens of millions of rubles worth of imported chemical equipment -- much of it from the Free World -- lying around unused. 12/ Other complaints concern the exposure of the delicate chemical equipment to weather damage, rough handling, and pilfering. Such negligence has resulted in delayed startups of new plants, premature breakdown of the equipment, and low quality of production.

A shortage of skilled workers and qualified engineering and supervisory personnel needed to construct chemical plants supplied by the Free World has been general in the Soviet Bloc. This deficiency has resulted in a slow pace of construction, increased maintenance costs, and an accelerated deterioration of buildings and

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equipment. Numerous examples illustrate this point. At one fiber plant in the USSR the foundation crumbled causing a floor to sink more than an inch after the equipment was installed. 13/ At a Soviet fertilizer plant, plumbing pipes were as much as 3 feet out of line at points that should have connected with the machinery, and Soviet builders "forgot" to lay a drainage system under the floor of the plant. Casual treatment of electrical fixtures and equipment also was reported. 14/ A chemical plant supplied by West Germany to Rumania reportedly was 50 percent behind schedule for construction at one time because of poor workmanship and bureaucratic inefficiency. 15/ At a Soviet fiber plant, recognition belatedly was given to the fact the floor would cave in if all machines ran simultaneously. 16/

An insufficient supply of tools and building materials and improper housing for equipment from the Free World also have been problems. Even the simplest tools are reported in short supply in the USSR and are often pilfered before being put to use. 17/ In the USSR the prevailing tendency apparently is to fit equipment supplied by the Free World into standard-sized structures, rather than to design buildings to accommodate the equipment.

#### B. Postconstruction Problems

Difficulties with chemical plants obtained from the Free World often continue beyond the construction stage. Although purchasers in the Soviet Bloc have stressed processes incorporating the most advanced technology, the lack of trained operating and maintenance personnel and high-quality input materials frequently precludes the efficient operation of these plants. Insufficient testing of individual components during the course of construction often results in a product of poor quality. Rather than close down a production line long enough to improve the quality of the product, the management often prefers to continue output of the low-quality product in the race for plant fulfillment. In the USSR a nylon-6 plant and a polyester resin shop supplied by the Free World could not go into production on completion, because of a lack of necessary input materials. 18/ Negligent and unqualified workers misuse the equipment, and the lack of preventive maintenance endangers the continued operation of new plants. Failure of a single part of the equipment occasionally has shut down a whole section of a plant for long periods.

#### V. Prospects

Barring a major change in the present order of their investment priorities, the countries of the Soviet Bloc probably will increase their purchases of chemical plants from the Free World in the next few years. Thus, in the next 6 to 7 years, purchases can be expected to exceed the \$1.3 billion made during 1957 through mid-1963 and, in

the light of present trends, could go as high as \$2 billion to \$3 billion if credit arrangements acceptable to the Bloc are widely available in the supplying countries.

This view is reinforced by the new Soviet program for the chemical industry during 1964-70 announced at the Plenum of the Central Committee held in December 1963. The new program calls for production of chemicals in 1970 to reach a level about three times that of 1963 and for direct investments in the chemical industry during 1964-70 to be at least 25 billion rubles, 2.5 times that of the slightly overlapping Seven Year Plan (1959-65). 19/ Aware of the need for tremendous quantities of equipment to implement this ambitious chemical program, Khrushchev stressed that the USSR will be in the market for chemical plants from the Free World if credit is available and no political conditions are attached. 20/ The data given at the December 1963 Plenum of the Central Committee, together with an assessment of Soviet and Eastern European capabilities for production of chemical equipment, suggest that considerable equipment will be required from the Free World to execute the new Soviet chemical program. The cost to the USSR of importing this amount of equipment and the associated technology during 1964-70 may run as high as \$2 billion.\* 21/

Likely prospects for increased purchases of chemical plants from the Free World by the Eastern European countries are predicated in large part on the continuation of the high interest in such purchases that apparently exists in Rumania and Poland, which at present are the two most active Eastern European countries in the acquisition of plants from the Free World. Any possible deterrent that the Council for Mutual Economic Development (CEMA) may have exercised on the scope of the development of the chemical industry in Rumania either was overcome or was defied by Rumanian leaders in 1963. The task of raising output of the Rumanian chemical industry 13 to 14 times by 1975 compared with 1959 22/ seems to imply continued heavy reliance on Free World suppliers of chemical plants. Furthermore, the unprecedented disclosure by Gheorghiu-Dej in late 1963 of the extent of participation of the Free World in major chemical projects in Rumania 23/ appears to be an invitation for further aid from the Free World.

\* The value of the equipment required to fulfill the new Soviet chemical plan (1964-70) is estimated at about 10 billion rubles (40 percent of the planned total investment of 25 billion rubles). On the basis of the estimated Soviet capability for production of such equipment, equipment valued at about 2 billion to 3 billion rubles would have to be imported to fulfill the plan. If the Eastern European countries supply equipment valued at 750 million rubles, rather than the planned 1 billion rubles, the value of equipment required from the Free World to execute the program fully would be 1.25 billion to 2.25 billion rubles, or perhaps about \$2 billion (about \$1.4 billion to \$2.5 billion at the official rate of exchange).

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In a more direct manner, Rumania in 1963 was making determined efforts to obtain petrochemical plants from the US. 24/ Poland, like Rumania, is resolved to expand its chemical industry and reportedly in 1963 was prepared to spend \$100 million to purchase petrochemical technology alone from the US, the UK, or Italy. 25/ This figure is far in excess of the estimated value of Polish purchases of chemical plants from the Free World during 1957 through mid-1963.

East Germany and Czechoslovakia, the only two Eastern European countries with significant domestic outputs of chemical equipment, also apparently plan to increase their purchases of chemical equipment from the Free World. In January 1963 the East German Council of Ministers approved the expenditure of about \$75 million during the next few years for the purchase from the Free World of plants and equipment for the East German chemical industry. 26/ This amount is more than double the value of comparable East German purchases during 1957 through mid-1963. In early 1963 a Czechoslovak trade commission reportedly arranged orders for purchases of chemical plants and equipment from the UK amounting to about \$55 million, and reportedly purchases will be increased eventually to about \$239 million. 27/ A "shopping list" also was circulated by Czechoslovakia in the Free World for six large chemical plants, 28/ the value of which could be more than \$50 million.

Hungary, Bulgaria, and Albania endeavored in 1963 to overcome a lack of foreign exchange and credits to obtain chemical plants from the Free World. The value of Hungarian contracts for Free World chemical plants in the first half of 1963 alone exceeded the value of similar contracts for the entire period during 1957-62. Belgium, the main source of these purchases, reportedly extended credits of 6 to 12 years, in contrast to the previous maximum of 5 years allowed by countries of the Free World, and agreed to accept 50 percent of the payment in Hungarian goods. 29/ The accelerated pace of Hungarian purchases from the Free World continued past mid-1963 with the conclusion of contracts with West Germany for a plastics processing plant 30/ and with the UK for a polyurethane foam plant. 31/ The amount to be spent in support of the Hungarian plan for 1965 reportedly is to be more than "several million pounds." 32/ Bulgaria purchased only one chemical plant from the Free World before mid-1963 but since then has contracted for equipment for "postnaphthol chemistry" from the UK 33/ and petrochemical equipment valued at \$8 million from Italy. In addition, Bulgaria plans to purchase more petrochemical equipment, worth \$56 million, from Italy 34/ and for the first time has presented the US with a "shopping list," which includes chemical plants valued at more than \$4 million. 35/ Albania, apparently through Communist China, has been negotiating with Italy for a petrochemical plant valued at more than \$11 million to be used for production of nitrogen fertilizer. 36/ According to a current trade agreement with Italy, Albania is to import an unspecified amount of chemical equipment, 37/ which may be used to establish production of such products as caustic soda and calcium carbide.

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APPENDIX A

SELECTED CONTRACTS  
FOR THE PURCHASE OF CHEMICAL EQUIPMENT AND TECHNOLOGY  
BY THE SOVIET BLOC FROM THE FREE WORLD  
1957 THROUGH MID-1963

The tables in this appendix listing the chemical plants and major components are believed to be reasonably comprehensive, but information on such trade frequently is incomplete, contradictory, and not current. An effort has been made to use only the more reliable reports as a basis for the tables, but a few inaccuracies may still exist. The tables probably understate the number of contracts for chemical plants concluded between the Soviet Bloc and firms of the Free World.

Table 4

Selected Contracts for the Purchase of Chemical Equipment and Technology  
by the USSR from the Free World  
1957 Through Mid-1963

Type of Plant	Production Capacity (Metric Tons Annually Unless Otherwise Indicated)	Price (Million Current US \$)	Country	Exporter Short Title of Firm	Plant Site	Contract	Date		Comments &/*
							Completion		
							Scheduled	Actual	
Chemical fibers and intermediates									
Viscose rayon <u>38/</u>	23,000	5	US	Von Kohn	Ryazan	1959	1960	1960	For the manufacture of textiles.
Viscose rayon <u>39/</u>	50 per day	25	Italy	Chetillon	Balakovo	1959	1962	1963	For tire cord.
Viscose rayon	50 per day		UK	Courtaulds	Engel's	1959	1961	1962	For tire cord.
Acrylic fiber	N.A.	55	UK	Courtaulds	Saratov	1959	1961	N.A.	
Acetate filament	N.A.		UK	Courtaulds	Engel's	1959	1961	1962	
Acetate fiber <u>40/</u>	N.A.		UK	Courtaulds	Leninakan	1959	N.A.	N.A.	
Viscose processing <u>41/</u>	N.A.	N.A.	Italy	Chetillon	Kemensk Svetlogorsk	N.A.	N.A.	N.A.	Contract for two plants, which will be used for sulfatization and decaration.
Cellulose <u>42/</u>	100,000	21.6	Finland	Rauma Repola	Near Lake Baykal	1960	1962	N.A.	Basic material for tire cord; in construction in 1963.
Cellulose <u>43/</u>	40,000 b/	N.A.	Sweden	Karlstads Uddeholm	Bretsk	1959	1962-63	N.A.	Basic material for tire cord. Construction had not started as of mid-1962.
Cellulose <u>44/</u>	N.A.	12.2	Belgium	Houget de Verviers	Leningrad Penza	1962	N.A.	N.A.	For two plants; delivery of equipment to start in 1963.
Cellulose	100,000	24.9	France	Parsons and Whittemore	Komsomol'sk- na-Amure	1960	1964	N.A.	Basic material suitable for super-high-tensile rayon tire cord.
Cellulose	85 per day	N.A.	France	Parsons and Whittemore	N.A.	1958	N.A.	N.A.	
Cellulose <u>45/</u>	N.A.	3.3	France	Parsons and Whittemore	N.A.	1961	N.A.	N.A.	
Cellulose <u>46/</u>	200,000	16	Italy	Sila Viscosa	Archangel'sk	1961	1963	N.A.	Basic material for paper and cardboard.
Nylon-6 <u>47/</u>	20 per day	N.A.	West Germany	Karl Fischer	N.A.	1962	N.A.	N.A.	Basic material for tire cord.

\* Footnotes follow on p. 28.



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Table 4  
(Continued)

Type of Plant	Production Capacity (Metric Tons Annually Unless Otherwise Indicated)	Price (Million Current US \$)	Exporter		Plant Site	Date		Comments a/
			Country	Short Title of Firm		Contract	Completion Scheduled Actual	
Chemical fibers and intermediates (Continued)								
Nylon-6 <u>48/</u>	40 per day	N.A.	West Germany	Zimmer	Barnaul	1959	1960	1960
			West Germany	Leybold				
			Italy	Snla Viscosa				
			UK	Dobson Barlow Scrags				
								Production problems have occurred at this plant from the startup through 1963. Part of the equipment was supplied by the USSR. Soviet and Free World equipment had defects. Snla Viscosa also has completed a small facility of unknown capacity at Kiev.
Nylon-66 <u>49/</u>	6,000	11.3	UK	Vickers-Armstrong	Chernigov	1961	1965	N.A.
			West Germany	Zimmer				For yarn and cord.
Caprolactam <u>50/</u>	10,000	6.8	West Germany	Zimmer	Kemerovo	1958	1962	1962
								Intermediate for production of nylon.
Caprolactam <u>51/</u>	5.5 per day	4.8	Italy	Snla Viscosa	Rustavi Chernigov	1961	N.A.	1963
								For two plants, for which payment will be made within 4 to 5 years.
AM salt <u>52/</u>	10,000	6.4	West Germany	Zimmer	Lisichansk	1959	1961	N.A.
								Intermediate for manufacture of nylon-66; in construction in 1963.
Hydrogen cyanide <u>53/</u>	N.A.	N.A.	West Germany	Zimmer	Kiev	N.A.	N.A.	1961
								Intermediate for manufacture of acrylonitrile.
Catalysts <u>54/</u>	200	1	West Germany	Zimmer	Kemerovo	1961	1962	N.A.
								Was to produce 20 types of catalysts for chemical fibers. The USSR was dissatisfied with results and developed its own type.
Dacron <u>55/</u>	3,500	5	US	Von Kohn	Kursk	1958	1960	1962
								Raw material for this plant to be supplied from the Krupp plant at Novomoskovsk.

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Table 4

Selected Contracts for the Purchase of Chemical Equipment and Technology  
by the USSR from the Free World  
1957 Through Mid-1963  
(Continued)

Type of Plant	Production Capacity (Metric Tons Annually Unless Otherwise Indicated)	Price (Million Current US \$)	Exporter		Plant Site	Contract	Date		Comments g/ 
			Country	Short Title of Firm			Completion Scheduled	Actual	
Chemical fibers and intermediates (Continued)									
Dacron	3,500	10.8	West Germany	Krupp	Kursk	1957	1960	1961	Plant for fiber.  Raw material for dacron and for dimethyl terephthalate. In 1962 or 1963 a contract was signed to expand the paraxylol plant.
Dimethyl terephthalate	6,000				Novomoskovsk	1958	1960	1960	
Paraxylol 56/	8,000				Novoknyazhev	N.A.	1960	N.A.	
Dacron	3,500	9	West Germany	Krupp	Kursk	1963	N.A.	N.A.	These plants are to double the existing capacity installed by Krupp.
Dimethyl terephthalate	6,000				Novomoskovsk	1963	N.A.	N.A.	
Paraxylol 57/	8,000				Irkutsk	1962	1964	N.A.	
Triacetate yarn 58/	N.A.	17	UK	Courtaulds	Kaunas	1962	1964	N.A.	Delivery of this plant to start in 1963.
Cellulose acetate 59/	50 per day	15 c/	France	Speichim	Yerevan	1960	1961	1963	The end products of this plant are to be fiber and plastic.
Acetic anhydride 60/	20,000	N.A. c/	France	Speichim	Probably Laischansk	1960	N.A.	1963	Acetic anhydride will be made as a byproduct of cellulose acetate.
Dimethylolethylene urea 61/	12,000	2.1	UK	Wycon	Sterlitamak	1961	1964	N.A.	Product for wrinkle-proofing of drip-dry fabrics. The plant was in construction in 1962.
Ethylene diamine 62/	3,000	5.3	Italy	Montecatini	Sterlitamak	1961	N.A.	N.A.	Intermediate in production of dimethylolethylene urea. The plant was in construction in 1962.
Basic petrochemicals									
Ammonia	400 to 450 per day	24.2	Italy	ENI	Tula	1961	1963	N.A.	One plant each.
Methanol 63/	650 per day		Italy	ENI	Tula	1961	1963	N.A.	

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Table 4  
(continued)

Type of Plant	Production Capacity (Metric Tons Annually Unless Otherwise Indicated)	Price (Million Current US \$)	Exporter		Plant Site	Contract	Completion		Comments g/
			Country	Short Title of Firm			Scheduled	Actual	
Basic petrochemicals (Continued)									
Ammonia 64/	350 per day	11.3	Italy	Montecatini	Dzerzhinsk	1960	N.A.	N.A.	Plant in construction in 1962.
Ammonia 65/	120,000	N.A.	West Germany	Lurgi	Neftnomysk	1962	1964	N.A.	
Ammonia 66/	N.A.	N.A.	Italy	Montecatini	Sterlitamak	N.A.	N.A.	N.A.	Plant in construction in 1963.
Ammonia	400 per day			ERI	Novomoskovsk	1960	1962	1962	{ For an ammonia plant and an acetylene plant, both to be based on natural gas.
Acetylene 67/	200 per day	10.5		SBA	Novomoskovsk	1960	1963	N.A.	
				Belgium	ERI				
Acetylene 68/	35,000	6.2	West Germany	BASF	Lisichansk	1959	1961	1963	
Acetylene and ethylene 69/	N.A.	25 d/	Italy	Montecatini	Sterlitamak	1959	N.A.	N.A.	One plant each based on fuel oil and both in construction in 1962.
Acetylene	35,000	N.A.	Belgium	ERI	Angarsk	1961	N.A.	N.A.	{ One plant each and both in construction in 1962.
Ethylene 70/	70,000	N.A.	Belgium	SBA	Angarsk	1961	N.A.	N.A.	
Ethylene 71/	120,000	17	UK	ERI	Novomoskovsk	1960	1962	1962	{ For an ammonia plant and an acetylene plant, both to be based on natural gas.
				SBA	Novomoskovsk	1960	1963	N.A.	
				ERI					
Ethylene oxide 72/	N.A.	N.A.	Italy	Montecatini	Dzerzhinsk	1960	N.A.	N.A.	Plant in construction in 1962.
Plastics, plastics processing, and intermediates									
Polyethylene	24,000	15	West Germany	Salzgitter	Salavat	1959	1960	1962	High-pressure process.
Polyethylene	24,000	14	West Germany	Salzgitter	Kuybyshev	1960	1961	1961	Low-pressure process
Polyethylene	24,000	9.2	West Germany	Salzgitter	Ufa e/	1963	1965 f/	N.A.	{ One plant each for the high-pressure process and the low-pressure process.
Polyethylene 73/	24,000	N.A.	West Germany	Salzgitter	Kazan' e/	1963	N.A.	N.A.	
Polyethylene 74/	144,000	56	UK	Simon-Carves	N.A.	1963	N.A.	N.A.	

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The contract is for \$36 million in credit to be repaid in 5 years starting in 1967. A total of six plants is to be in four locations, one of which is Angarsk.

Table 4

Selected Contracts for the Purchase of Chemical Equipment and Technology  
by the USSR from the Free World  
1957 Through Mid-1963  
(Continued)

Type of Plant	Production Capacity (Metric Tons Annually Unless Otherwise Indicated)	Price (Million Current US \$)	Country	Exporter Short Title of Firm	Plant Site	Contract	Date		Comments &/
							Completion		
							Scheduled	Actual	
Basic petrochemicals (Continued)									
Polypropylene 15/	10,000	15.6	West Germany	Salzgitter	N.A.	1960	N.A.	N.A.	There are indications that a contract cancellation may have been requested because of patent infringement problems of the supplier.
Polypropylene 16/	N.A.	N.A.	Italy	Montecatini	Steriltamak	1962	N.A.	N.A.	Plant in construction in 1963.
Polyurethane 17/	N.A.	Several	West Germany	Bayer	Moscow	N.A.	N.A.	1959	Output to be used for foams and solids.
Polyisobutylene 18/	5,000	1.8	UK	P.K. Engineering	Gorlovka	1959	N.A.	1962	Suspension polymerization process.
Polyisobutylene molding powder 19/	10,000	2.1	UK	Sterling Molding Materials	Gorlovka	1961	N.A.	1962	Bulk polymerization process.
Polyester resins 20/	6,000	N.A.	UK	Kestner Evaporator	Probably Zhilovo	N.A.	N.A.	N.A.	Output to be used in production of passenger automobile and truck bodies from glass reinforced plastics.
Cellophane 21/	12 per day	N.A.	Switzerland	Maurer	Barmal	1958	1959	1961	
Plastic pipe 22/	10,000	1	US	OMNI	"In the Urals"	1959	1960	N.A.	Equipment for fabrication of polyethylene and polyvinyl chloride plus 600 tons per year of plastic fittings.
Cellulose acetate 23/	3,000	N.A.	UK	East Anglia	N.A.	1960	N.A.	N.A.	
Maleic anhydride 24/	N.A.	N.A. &/	Italy	Montecatini	Tambov	1959	N.A.	1962	

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Table 4  
(Continued)

						Date	
						Completion	
						Scheduled	Actual
						Comments a/	
Type of Plant	Production Capacity (Metric Tons Annually Unless Otherwise Indicated)	Price (Million Current US \$)	Country	Exporter Short Title of Firm	Plant Site	Contract	
Agricultural chemicals							
Urea <u>85/</u>	2,000 per day	24.9	Netherlands	Stork Werspoort	Chirchik Salavat Shebekino Lisichansk	1960 1960 1960 1962	1963 N.A. N.A. N.A.
Ammonium nitrate <u>86/</u>	600 per day	N.A.	Belgium	Probably ERI Probably SBA	Novomoskovsk	1961	1962 N.A.
Ammonium sulfate <u>87/</u>	2,000 per month	0.8	UK	Simon-Carves	Near Moscow	1962	N.A. N.A.
Phosphoric acid <u>88/</u>	1,250,000	22.5 £/	Belgium	Fraxon Co.	N.A.	1963	N.A. N.A.
Phosphoric acid <u>89/</u>	166 per day 1/	15 £/	France	Spelchim	N.A.	1960	N.A. N.A.
Phosphorus <u>90/</u>	45,300	25 £/	West Germany	Unde	Tashkent	1962	N.A. N.A.
Phosphorus fertilizer <u>91/</u>	N.A.	N.A.	Belgium	UCB	N.A.	1962	N.A. N.A.
Fertilizer <u>92/</u>	N.A.	17	West Germany	Knapack-Ortelsheim	N.A.	1962	1965 N.A.
Monochlorophenoxy acetic acid <u>93/</u>	4,200	3.8	UK	Wycon	Ufa	1961	1964 N.A.
Simazin <u>94/</u>	6,000	10.3	West Germany	Lurgi	N.A.	1961	N.A. N.A.
The end product of this plant is for a herbicide.							

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Table 4

Selected Contracts for the Purchase of Chemical Equipment and Technology  
by the USSR from the Free World  
1957 Through Mid-1963  
(Continued)

Type of Plant	Production Capacity (Metric Tons Annually Unless Otherwise Indicated)	Price (Million Current US \$)	Exporter		Plant Site	Contract	Date		Comments 2/
			Country	Short Title of Firm			Completion	Actual	
Rubber and rubber products									
Tires 25/	2,000,000 tires per year	4.3	UK	Ruslyte	Dnepropetrovsk	1959	1960	1961	Complete plant
Tires 26/	3,000,000 tires per year	9	UK	Simon-Handling George W. King	Volzhskiy	1961	1964	N.A.	For equipment for handling, storing, and weighing of raw materials.
Tires 27/	1,000 tires per day	1.2	Italy	Pirelli	Yaroslavl <sup>1</sup>	1961	N.A.	N.A.	For equipment for intermediate phase of the production.
Synthetic rubber 28/	N.A.	18.2	UK	Dalglish	See the com- ments	See the comments			For equipment. The dollar fig- ure includes five contracts of varying size (from \$1.4 million to \$10 million) during 1959-63 for equipment for filtration, drying, and packaging of syn- thetic rubber. The only known location is Omsk, to which delivery has already been com- pleted.
Synthetic rubber 29/	8,200	N.A.	West Germany	Hennecke	N.A.	1958	N.A.	N.A.	For equipment.
Synthetic rubber 100/	N.A.	1.5	US	Proctor-Silex	N.A.	1960	N.A.	N.A.	For equipment.
Other chemicals									
Caustic soda	N.A. 2/	8	France	Krebs	Sterilitemak	1959	N.A.	N.A.	{ For an electrolytic plant; in construction in 1963.
Chlorine 101/	N.A.		France	Krebs	Sterilitemak	1959	N.A.	N.A.	
Nitric acid	N.A.	N.A.	France	Speichim	Near Moscow	N.A.	N.A.	N.A.	{ For one plant each.
Sulfuric acid 102/	N.A.	N.A.	France	Speichim	Dombas area	N.A.	N.A.	N.A.	
Sodium sulfate 103/	40 per day	2	West Germany	Lurgi	N.A.	1960	N.A.	N.A.	For a vacuum crystallizer plant.
Oxygen 104/	15,000 cubic meters per hour	14	Japan	Kobe	N.A.	1961	1963	N.A.	The six oxygen units purchased are to be located at fertilizer plant sites. Nitrogen also is produced as a byproduct of oxygen.

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Table 4  
(Continued)

Type of Plant	Production Capacity (Metric Tons Annually Unless Otherwise Indicated)	Price (Million Current US \$)	Exporter		Plant Site	Contract	Date		Comments #/
			Country	Short Title of Firm			Completion Scheduled	Actual	
Other chemicals (Continued)									
Oxygen 105/	N.A.	N.A.	West Germany	Linde	Novo-Lipetsk	1962	1965	N.A.	Plant to be used as part of an oxygen converter steel plant.
Synthetic fatty acids	5,000		UK	CTB Marchon Products	Volgodonsk D/ Shebekino D/	1960	1963	N.A.	It is believed that there will be an acids unit and an alcohols unit at both locations. Output is to be used for the manufacture of synthetic detergents.
Synthetic fatty alcohols 106/	5,000	8.4	UK	CTB Marchon Product	Volgodonsk D/ Shebekino D/	1960	1963	N.A.	
Polyvinyl pyrrolidone	180		West Germany	Zimmer	Shvartssevskiy	1958	1961	N.A.	One plant each and both near completion in 1963. The polyvinyl pyrrolidone is to be used in the manufacture and preservation of blood plasma. Methyl pyrrolidone is a solvent for acetyleme.
Methyl pyrrolidone 107/	250 g/	2	West Germany	Zimmer	Shvartssevskiy	1958	1961	N.A.	
Silica	5,000	2.2	West Germany	De Gussa	Possibly Kaluzhskiy	N.A.	1961	N.A.	For one plant each.
Silicon tetrachloride 108/	15,000	0.8	West Germany	De Gussa	Possibly Kaluzhskiy	N.A.	1961	N.A.	
Titanium dioxide 109/	35,000	N.A. P/	Italy	Montecatini	Sunny	1959	N.A.	N.A.	Plant in construction in 1963. Output is to be used chiefly as a pigment.
Purified g/ 110/	5,000	N.A.	Sweden	Skogh	Shumeriya	N.A.	N.A.	1960	
Sodium tripolyphosphate 111/	30,000	N.A.	Belgium	UCB	N.A.	1961	N.A.	N.A.	The plant is to produce a detergent raw material.
Phosphorus pentasulfide 112/	N.A.	0.5	UK	Humphreys and Glasgow	N.A.	1963	N.A.	N.A.	Output of this plant used as an intermediate for tube oil additives, insecticides, flotation agents, and rubber additives.
Carbon black dust 113/	N.A.	2.5	UK	Stavely Industries	N.A.	1962	1963	N.A.	For dust-collecting equipment.

Table 4

Selected Contracts for the Purchase of Chemical Equipment and Technology  
by the USSR from the Free World  
1957 Through Mid-1963  
(Continued)

Type of Plant	Production Capacity (Metric Tons Annually Unless Otherwise Indicated)	Price (Million Current US \$)	Exporter		Plant Site	Contract	Date		Comments &/
			Country	Short Title of Firm			Completion Scheduled	Actual	
Other chemicals (Continued)									
Coke Gas purification 114/	440 per day	9.1	France	L'Air Liquide	Rastorguyev	1960	1964	N.A.	Two installations. The ammonia equipment itself is to be made in the USSR. Ethylene purifi- cation equipment also may be included in the contract. This contract is for installations to purify coke gas to make ammonia.
	440 per day	9.9	France	L'Air Liquide	Lipetsk	1960	1963	N.A.	

- When no comments are made, the contract is for a plant.
- The Soviet-Swedish Trade Agreement for 1959 to 1961 specified exports of three installations for production of cellulose pulp with a combined capacity of 580,000 tons, but confirmation of actual sales is lacking.
- Part of a \$30 million contract for phosphoric acid, cellulose acetate, acetic anhydride, and amino acids.
- Part of a \$23 million contract including plants for acetylene, ethylene, titanium dioxide, and maleic anhydride.
- It is not known which plant is to be at Ufa and which at Kazan.
- Delivery date.
- Part of a \$25 million contract including plants for acetylene, ethylene, titanium dioxide, and maleic anhydride.
- In addition to the contract for four complete urea plants, a Soviet-Netherlands contract apparently exists calling for the delivery of nine reactors for other urea plants, but some of the details of the latter contract are not yet available.
- The cost of such equipment in the US.
- Capacity from the French-Soviet trade agreement for 1960.
- Part of a \$30 million contract including plants for phosphoric acid, cellulose acetate, acetic anhydride, and amino acids.
- The cost of such equipment in the US.
- Numerous conflicts exist in reports on capacity.
- It is not known what type of facility will be at each location.
- Negotiations are underway to expand methyl pyrollidone capacity to 1,000 metric tons annually.
- Part of a \$23 million contract including plants for acetylene, ethylene, titanium dioxide, and maleic anhydride.
- Reports exist on Soviet orders of up to three more furfural plants from the Free World.



Selected Contracts for the Purchase of Chemical Equipment and Technology  
by Rumania from the Free World  
1957 Through Mid-1963

Table 5

Type of Plant	Production Capacity (Metric Tons Annually Unless Otherwise Indicated)	Price (Million Current US \$)	Exporter		Plant Site	Contract	Date		Comments a/
			Country	Short Title of Firm			Scheduled	Actual	
Chemical fibers and intermediates									
Nylon-6 and dacron <u>115/</u>	N.A.	N.A.	West Germany	Zimmer	Bucharest: Dudesti- Cioplea	About 1956-58	N.A.	About 1959	Pilot plant for each. The purchase probably is connected with the purchase of installa- tions for Savinesti.
Orlon <u>116/</u>	300	N.A.	West Germany	Zimmer	Savinesti	1956-58	N.A.	1961	Industrial-scale pilot plant.
Nylon-6 and caprolactam	2,000 b/	1	West Germany	Zimmer	Savinesti	1956-58	1959	1960	Plant and technology. UK and French equipment reportedly also are installed.
Orlon and acrylonitrile	5,000 b/	10	West Germany	Zimmer	Savinesti	1956-58	N.A.	1962	
Nylon-6 and caprolactam <u>117/</u>	5,000 b/	8.5	West Germany	Zimmer	Savinesti	1963	1965	N.A.	New equipment to expand capacity.
Rayon fiber and paper <u>118/</u>	N.A.	6.0	West Germany	O. Wolff	Brelia: Chisecani	1961	1964	N.A.	Equipment and technology.
		1.5	Austria	Voest					
		6.0	Switzerland	Maurer					
Rayon tire cord and cellulose <u>119/</u>	N.A.	16.0	Italy	Chatillon	Brelia: Chisecani	1962	1965	N.A.	Chatillon is supplying the tire cord plant and Buckeye the cellulose plant (valued at US \$2.4 million).
			US	Buckeye					
Nylon tire cord <u>120/</u>	N.A.	7.75	West Germany	Zimmer	Savinesti	1962	1965	N.A.	Equipment for expansion of plant previously purchased from West Germany.

a. When no comment is made, the contract is for a plant.  
b. Capacity for the first-named type of plant.

Table 5

Selected Contracts for the Purchase of Chemical Equipment and Technology  
by Rumania from the Free World  
1957 Through Mid-1963  
(Continued)

Type of Plant	Production Capacity (Metric Tons Annually Unless Otherwise Indicated)	Price (Million Current US \$)	Country	Exporter	Plant Site	Contract	Date		Comments
				Short Title of Firm			Completion Scheduled	Actual	
Basic petrochemicals									
Methanol <u>121/</u>	9,000	N.A.	West Germany	Lurgi	Victoria	1958	N.A.	1961	The installation provides feedstock for formaldehyde unit at the site.
Acetylene <u>122/</u>	35,000	7.0	Belgium	SBA ERA	Craiova	1961	N.A.	N.A.	Equipment and technology. Natural gas will be feedstock.
Ethylene and propylene <u>123/</u>	35,000 and 20,000, respectively	7	Italy	Montecatini	Brazi	About 1960	N.A.	N.A.	For technical assistance and equipment at a polyethylene plant.
Ethylene oxide and glycol <u>124/</u>	N.A.	6.0	Italy	Montecatini	Brazi	Since 1960	N.A.	N.A.	Price may be connected with or included in the above contract.
Methanol <u>125/</u>	30,000	N.A.	Italy	Snam-Progetti	Victoria	1962	N.A.	N.A.	Plant to use natural gas as feedstock. It is an addition to existing unit.
Synthesis gas <u>126/</u>	N.A.	N.A.	Belgium	SBA	Possibly Craiova	About 1963	N.A.	N.A.	Planning and plant. The process is to be that held jointly by SBA and Topsoe of Denmark. Natural gas is to be used to produce ammonia and methanol.
Ammonia <u>127/</u>	100,000	N.A.	West Germany	Ude	Turnu Magurele	1963	1965	N.A.	Output of this plant is to be used for production of compound fertilizers. The original location apparently was planned to be Urziceni near Bucharest.
Butanol <u>128/</u>	N.A.	1.1	Italy	Montecatini ENI	N.A.	1959	N.A.	N.A.	Plant possibly connected with phthalic anhydride installation at Timisoara.
Carbon black <u>129/</u>	About 40,000	4.8	France	Commentry-Oiselet	Pitești	1962	N.A.	N.A.	Plant to use natural gas as feedstock.

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Table 5  
(Continued)

Type of Plant	Production Capacity (Metric Tons Annually Unless Otherwise Indicated)	Price (Million Current US \$)	Exporter		Plant Site	Contract	Date		Comments
			Country	Short Title of Firm			Completion Scheduled	Actual	
Basic petrochemicals (continued)									
Petrochemicals <u>130/</u>	N.A.	17 6.0 3.4	US France Italy	HRI ENSA Ansaldo	Brazil Brazil Brazil	1959 1959 1959	1962 1962 1962	N.A. N.A. N.A.	All three firms participated in construction of the refinery and petrochemical combine. The price given comprises both that for the refinery and that for the petrochemical combine. The French contribution includes ortho- and para-xylene units. The Italian contribution includes containers.
Plastics and intermediates									
Polystyrene <u>131/</u>	6,500	2.1	UK	Petrocarbon	Opesit: Borzestl	1961	1965	N.A.	Highly automated. A styrene-butadiene rubber plant is located at the same site.
Polyethylene <u>132/</u>	24,000	About 6.3	UK	ICI Simon-Carves	Brazil	1961	1965	N.A.	Equipment and technology for a high-pressure polyethylene plant. Czechoslovakia, Poland, and East Germany each obtained a similar plant at the same time.
Formaldehyde <u>133/</u>	27,000	N.A.	Italy	Montecatini	Victoria	N.A.	N.A.	1962	Plant construction plus technicians.
Phthalic anhydride <u>134/</u>	7,000	N.A.	West Germany	Lurgi	N.A.	1963	1965	N.A.	
Agricultural chemicals									
Phosphoric acid and compound fertilizer <u>135/</u>	60,000 and 400,000, respectively	3.4	France	ENSA	Turmu Mogurele	1962	1964	N.A.	Plant to use the Dorr-Oliver process. The sulfuric acid plant at the site is from West Germany.
Phosphorus fertilizer <u>136/</u>	About 54,000 (P <sub>2</sub> O <sub>5</sub> )	N.A.	West Germany	Lurgi	Novodari	About 1959	N.A.	1962	Equipment for expansion of plant originally built by the USSR.

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Table 5

Selected Contracts for the Purchase of Chemical Equipment and Technology  
by Rumania from the Free World  
1957 Through Mid-1963  
(Continued)

Type of Plant	Production Capacity (Metric Tons Annually Unless Otherwise Indicated)	Price (Million Current US \$)	Exporter		Plant Site	Contract	Date		Comments
			Country	Short Title of Firm			Scheduled	Actual	
Agricultural chemicals (Continued)									
Urea <u>137/</u>	100,000	N.A.	West Germany	Unide	Craiova	1963	1965	N.A.	Plant to use the Netherlands process (Stamcarbon)
Phosphoric acid <u>138/</u>	10,000 (P <sub>2</sub> O <sub>5</sub> )	2.0	Belgium	UCB	Valcea Calugareasca	1961	N.A.	N.A.	Plant and technology. The process is a joint Belgian-French process. The price includes a sodium tri-polyphosphate plant.
Pesticides <u>139/</u>	10,000	N.A.	West Germany	MLAG	Bucharest: Ducesti- Cioplea	Before 1961	N.A.	1961	Equipment for a pesticides installation.
Rubber and rubber products									
Styrene-butadiene synthetic rubber <u>140/</u>	N.A.	N.A.	West Germany	Boehmen	Onesti: Borzești	About 1960	1963	N.A.	Although the major part of the equipment was obtained from the USSR and Czechoslovakia, West Germany supplied technicians and equipment for separating, drying, and packaging synthetic rubber.
Tires <u>141/</u>	1 million tires annually	22	UK	Rustya	Popești-Leordeni	1959	N.A.	1962	The complete plant was purchased from the UK and installed by UK technicians, some of whom are still at the plant site.
Tires <u>142/</u>	N.A.	N.A.	UK	Rustya	Floresti	1959	N.A.	N.A.	Equipment was used to expand an existing plant. The price may have been included in the purchase of a plant at Popești-Leordeni.
Rubber processing <u>143/</u>	N.A.	1.5	West Germany	N.A.	N.A.	1962	N.A.	N.A.	Fully automated plant.
Tires <u>144/</u>	N.A.	0.2	France	Repiquet	Popești-Leordeni	Since 1960	N.A.	1962	Equipment consists of molds for vulcanizing tires at a UK-built plant.

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Table 5  
(Continued)

Type of Plant	Production Capacity (Metric Tons Annually Unless Otherwise Indicated)	Price (Million Current US \$)	Country	Exporter		Plant Site	Contract	Date		Comments
				Short Title of Firm				Completion Scheduled	Actual	
Rubber and rubber products (Continued)										
Foam rubber <u>145/</u>	N.A.	N.A.	West Germany	Gloeckner	Bucharest	Before May 1960	N.A.	1961		Equipment was installed at the Anticorrosiv Plant.
Other chemicals										
Sulfuric acid <u>146/</u>	N.A.	N.A.	West Germany	Lurgi	Vala Calugareasca	About 1959	N.A.	N.A.		Equipment for expansion of an existing plant.
Sulfuric acid <u>147/</u>	100,000	N.A.	West Germany	Lurgi	Navodari	About 1959	N.A.	1962		Equipment for expansion of a phosphorus fertilizer plant originally built by the USSR.
Sulfuric acid <u>148/</u>	300,000	N.A.	West Germany	N.A.	Turnu Magurele	About 1963	1964	N.A.		Plant to be part of a new com- pound fertilizer combine.
Sodium tripolyphosphate <u>149/</u>	10,000	1.5	Belgium	UCB	Vala Calugareasca	1961	N.A.	N.A.		The plant was purchased along with a phosphoric acid plant.
Chlorine and caustic soda <u>150/</u>	N.A.	N.A.	Italy	Oronzio de Nora	Braila: Chiscenti	About 1962	N.A.	N.A.		Plant to be part of a reed cellulose combine.
Boilers and other equipment <u>151/</u>	N.A.	N.A.	West Germany	Boehnen and other West German firms	Oresti: Borzesti	About 1962	About 1963	N.A.		The equipment may be for a chloralkali or polyvinyl chloride installation at the site. West German technicians also were used.
Soda ash <u>152/</u>	80,000	N.A.	West Germany	Zieren	Oana Mures or Govora	1963	1964	N.A.		Complete concentrated soda plant.
Paint <u>153/</u>	N.A.	0.5	Italy	Infrarot	Braşov	Since 1960	N.A.	N.A.		The paint plant is part of a truck plant.
Furfural <u>154/</u>	6,000	1.0	Sweden	Defibrator Skogh	Possibly Braila: Chiscenti	1963	N.A.	N.A.		Plant to use reeds from the Danube as feedstock.

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Table 6

Selected Contracts for the Purchase of Chemical Equipment and Technology  
by Poland from the Free World  
1957 Through Mid-1963

Type of Plant	Production Capacity (Metric Tons Annually Unless Otherwise Indicated)	Price (Million Current US \$)	Country	Exporter Short Title of Firm	Plant Site	Contract	Date		Comments a/
							Completion		
							Scheduled	Actual	
Chemical fibers and intermediates									
Orlon <sup>155/</sup>	10,000	5.6	UK	Courtaulds	Lodz	1961	1964	N.A.	
Viscose cellulose <sup>156/</sup>	40,000	11	Finland	Metex	Swiecie	1962	1964-65	N.A.	Plant and technology. The purchase may be intended for a proposed rayon plant at Brzezine near Wloclawek.
Dacron <sup>157/</sup>	7,000	1.4	UK	ICI	Torun	1959	1964-65	N.A.	Technology and part of the equipment.
Acrylonitrile <sup>158/</sup>	16,000	N.A.	France	N.A.	Tarnow	Before 1963	1964	N.A.	Technology. The product is to be sent to an orlon plant at Lodz. The equipment is to be obtained from "capitalist countries."
Basic petrochemicals									
Olefins <sup>159/</sup>	N.A.	8.4	UK	Humphreys and Glasgow	N.A.	1962	N.A.	N.A.	The plant may be intended for the petrochemical combine at Plock.
Petrochemicals <sup>160/</sup>	N.A.	N.A.	Italy	Shaw-Progett	Plock	1961	1965	N.A.	Platforming and distillation unit.
Acetylene <sup>161/</sup>	N.A.	N.A.	Italy	Montecastini	Tarnow	1959	N.A.	N.A.	Technology and equipment to use natural gas to produce acetylene, hydrogen, and carbon dioxide.
Ammonia <sup>162/</sup>	N.A.	2.5	Italy	ENI Nuovo Pignone	Pulawy	1963	N.A.	N.A.	The equipment includes 25 compressors. Six are for ammonia, five for oxygen, six for carbon dioxide, four for methane, and four for compressed air. The combine at Pulawy will process natural gas.

a. When no comment is made, the contract is for a plant.

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Table 6  
(Continued)

Type of Plant	Production Capacity (Metric Tons Annually Unless Otherwise Indicated)	Price (Million Current US \$)	Country	Exporter		Plant Site	Contract	Date		Comments
				Short Title of Firm				Scheduled	Completion Actual	
Plastics and intermediates										
Methyl methacrylate 163/	N.A.	N.A.	Austria	Boehler Bros.	N.A.	About 1962	N.A.	N.A.	N.A.	Plant for methyl methacrylate monomer.
Polyethylene 164/	24,000	About 6.3	UK	ICI Simon-Carves	Blachownia	1961	1965	N.A.	N.A.	Poland collaborated with East Germany, Czechoslovakia, and Rumania in the purchase of the plant and technology.
Polystyrene 165/	10,000	1.0	UK	Petrocarbon	Oswiecim	1957	N.A.	1960	N.A.	The plant is still not operating at full capacity.
Agricultural chemicals										
Urea 166/	165,000	3.5	UK	Pover Gas	Kedzierzyn	1961	1963	N.A.	N.A.	The plant involves the use of the process of Toyo Kasei of Japan.
Rubber products										
Tires 167/	550,000 to 600,000 tires per year	N.A.	UK	N.A.	Debica	About 1960	1961	1961	1961	Equipment intended for a new automobile and motorcycle tire installation at the existing plant. Full capacity is not expected to be reached until 1964.
Other chemicals										
Phenol 168/	3,600	N.A.	West Germany	Krebskomo	Oswiecim	About 1962	N.A.	N.A.	N.A.	Equipment for expansion of the existing installation. The process is to involve the pressure hydrolysis of chlorobenzene in nickel-clad autoclaves.

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Table 6

Selected Contracts for the Purchase of Chemical Equipment and Technology  
by Poland from the Free World  
1957 Through Mid-1963  
(Continued)

Type of Plant	Production Capacity (Metric Tons Annually Unless Otherwise Indicated)	Price (Million Current US \$)	Country	Exporter		Plant Site	Contract	Date		Comments
				Short Title	of Firm			Completion	Actual	
Other chemicals (Continued)										
Air separation <u>159/</u>										
Oxygen and nitrogen respectively	970 and 1,546 per day,	5.6	UK	CJB		Tarnow	1961	1965	N.A.	Three air separation plants are to be provided by CJB with tech- nical data from HRI of the US. Output of nitrogen is to be used to produce ammonia.
Gas purification <u>170/</u>	N.A.	N.A.	France	L'Air Liquide		Kedzierzyn	1958	N.A.	1962	Equipment for separating the components of coke oven gas, primarily to produce ammonia.
Octanol and butanol <u>171/</u>	4,000 and 2,500, respectively	1.0	France	Krebs		Oswiecim	Before 1960	N.A.	1960	Technology and equipment.
Naphthalene <u>172/</u>	10,000	N.A.	France	N.A.		Zabrze	Before 1962	N.A.	1963	
Sulfuric acid <u>173/</u>	100,000	N.A.	France	N.A.		Torun	Before 1959	N.A.	1960	Technology and part of the equipment.
Salicylic acid <u>174/</u>	1,200	N.A.	US	N.A.		Starogard	About 1962	N.A.	N.A.	Two autoclaves for an existing pharmaceutical plant.

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Table 7

Selected Contracts for the Purchase of Chemical Equipment and Technology  
by Czechoslovakia from the Free World  
1957 Through Mid-1963

Type of Plant	Production Capacity (Metric Tons Annually Unless Otherwise Indicated)	Price (Million Current US \$)	Exporter		Plant Site	Contract	Date		Comments
			Country	Short Title of Firm			Completion Scheduled	Actual	
Chemical fibers									
Nylon-6 <u>175/</u>	N.A.	N.A.	West Germany	Zimmer	Humenne	About 1960	N.A.	1962	Although the plant was built with Soviet and East German help and was opened in 1959, West German equipment and tech- nicians also were used up to 1962.
Nylon tire cord <u>176/</u>	N.A.	2.8	UK	High Polymer and Petrochemical Engineering	Probably Humenne	Before 1960	N.A.	1960	Equipment and process.
Dacron <u>177/</u>	N.A.	0.6	UK	ICI	Plana nad Luznici	1961	By 1965	N.A.	Only the process was purchased originally. In 1963, "capita- list" (probably UK) machinery was reported being installed at the site.
Basic petrochemicals									
Ethylene and propylene <u>178/</u>	60,000 and 35,000, respectively	8.4	UK	Humphreys and Glasgow	Bratislava	1962	1965	N.A.	The plant is to provide the necessary chemical intermediates for polyethylene and polypropy- lene.
Ammonia and acetylene <u>179/</u>	N.A.	N.A.	Italy	Montecatini	Sal'a nad Velcom	1960	1962	N.A.	Technology for a nitrogen fer- tilizer and chloroprene plant. Difficulties apparently still prevail in regard to beginning full-scale production of both products. Some Czechoslovak imports of chemical equipment from Italy may have been for these plants.

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Table 7

Selected Contracts for the Purchase of Chemical Equipment and Technology  
by Czechoslovakia from the Free World  
1957 Through Mid-1963  
(Continued)

Type of Plant	Production Capacity (Metric Tons Annually Unless Otherwise Indicated)	Price (Million Current US \$)	Exporter		Plant Site	Contract	Date		Comments
			Country	Short Title of Firm			Completion Scheduled	Actual	
Plastics									
Polyethylene 180/	24,000	About 6.3	UK	ICI Simon-Carves	Bratislava	1961	1965	N.A.	Complete high-pressure poly- ethylene plant, including designing, construction, and technology. Rumania, Poland, and East Germany each obtained a similar plant at the same time.
Rubber products									
Polyurethane foam 181/	N.A.	0.1	UK	Viking Engineering	N.A.	1961-62	N.A.	N.A.	Processing plant. Delivery is planned for 1963.
Tires 182/	N.A.	3	UK	Davy and United Simon Handling	N.A.	1961-62	N.A.	N.A.	The location is not known but could be for one of four exist- ing tire plants or a new plant to be built at Orskovice.
Other chemicals									
Benzol 183/	N.A.	N.A.	West Germany	Lurgi	Valasske Mezirci	Before 1962	1963	N.A.	Machinery and equipment for a new coke chemical plant.
Hydrochloric acid 184/	About 18,000	N.A.	West Germany	Krebs	Novaky	Before 1961	N.A.	About 1961	Plant with a total capacity of 2.4 metric tons per hour. The product is used for polyvinyl chloride.
Streptomycin 185/	300 liters per day	N.A.	UK	Edwards High Vacuum	Slovenska L'upca	About 1958	N.A.	1959	Vacuum plant.

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Table 8

Selected Contracts for the Purchase of Chemical Equipment and Technology  
by East Germany from the Free World  
1957 Through Mid-1963

Type of Plant	Production Capacity (Metric Tons Annually)	Price (Million Current US \$)	Country	Exporter		Plant Site	Contract	Date		Comments
				Short Title of Firm				Completion Scheduled	Actual	
Basic petrochemicals										
Ethylene 186/	40,000	14	UK	Humphreys and Glasgow		Merseburg	1960	N.A.	1962	The UK firm Petrocarbon is the licensor, but construction is by Humphreys and Glasgow. Initial production is scheduled to begin in 1963.
Ethylene 187/	40,000	4	West Germany	Lurgi		Merseburg	1963	N.A.	N.A.	Construction of total capacity of 80,000 tons of ethylene per year is planned to be completed by 1967.
"Petrochemicals" 188/	N.A.	0.6	Netherlands	Petja Co.		Schweft	1962	N.A.	N.A.	Contract for reactors and heat exchangers for petrochemical combine at Schweft.
Plastics and intermediates										
Polyethylene 189/	5,000	N.A.	West Germany	Imhausen		Merseburg	1959	N.A.	1962	For production of high-pressure polyethylene.
Polyethylene 190/	24,000	About 5	UK	ICI Simon-Carves		Merseburg	1961	1964	N.A.	Joint purchase by East Germany, Czechoslovakia, Poland, and Rumania. The total value for all four plants is about \$23.9 million.
Plastics dryer 191/	N.A.	0.2	West Germany	N.A.		Schkopau	1962	N.A.	N.A.	Contract awarded to a West German supplier.
"Plastics" 192/	N.A.	0.6	West Germany	MDAG		N.A.	1963	N.A.	N.A.	Contract to be part of a larger contract totaling about US \$2 million.
Rubber and rubber products										
Motor vehicle tires 193/	N.A.	1.4	UK	Rustya		Gittersee	1962	N.A.	N.A.	Equipment was purchased in July 1962.

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Table 8

Selected Contracts for the Purchase of Chemical Equipment and Technology  
by East Germany from the Free World  
1957 Through Mid-1963  
(Continued)

Type of Plant	Production Capacity (Metric Tons Annually)	Price (Million Current US \$)	Exporter		Plant Site	Date		Comment
			Country	Short Title of Firm		Contract	Completion Scheduled Actual	
Rubber and rubber products (Continued)								
Tires 194/	N.A.	1.8	UK	Rustya	Gittersee	1962	1963	N.A.
								East German representatives con- cluded the negotiations in November 1962. A 3-to-5-year credit was negotiated.
"Synthetic rubber" 195/	N.A.	1.3	West Germany	Soest-Ferrum Apparatebau	Schkopau	1963	N.A.	N.A.
								The rubber-processing installa- tion is to be the prototype of three additional plants of the Council for Mutual Economic Assistance (CEMA). The loca- tions of these plants are unknown.

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Table 9

Selected Contracts for the Purchase of Chemical Equipment and Technology  
by Hungary from the Free World  
1957 Through Mid-1963

Type of Plant	Production Capacity (Metric Tons Annually Unless Otherwise Indicated)	Price (Million Current US \$)	Country	Exporter Short Title of Firm	Plant Site	Contract	Date		Comments
							Completion Scheduled	Actual	
Chemical fibers									
Nylon-6 <u>196/</u>	N.A.	5	West Germany	Zimmer	Probably Nyergesujfalu	1963	1965	N.A.	Part of the equipment for the plant may be obtained in the UK or the Netherlands. A rayon plant and a nylon-6 pilot plant now exist at Nyergesujfalu.
Basic petrochemicals									
Ammonia <u>197/</u>	165,000	N.A.	Belgium	SBA ECOC-Rust	Kazincbarcika	1963	1966	N.A.	Ammonia equipment is included in the price of the urea contract and will enable the plant to double its output of fertilizer.
Synthesis gas <u>198/</u>	56,000 cubic meters per hour	N.A.	UK	Humphreys and Glasgow	Kazincbarcika	1963	1966	N.A.	Synthesis gas installation to be supplied under a subcontract for the urea plant from Belgium. US catalysts have been requested for use in installation.
Plastics and plastics processing									
Polyvinyl chloride <u>199/</u>	6,000	2	West Germany	Unde	Berente	1960	1962	1963	Plant, now based on calcium carbide, to switch to natural gas. A contract to expand the plant was signed about 1965.
						1963	N.A.	N.A.	
Synthetic resin and enamel paint <u>200/</u>	6,000	N.A.	France	Kestner	Tiszapalkonya	1959	1960	1961	Additional equipment was received from East and West Germany and the UK.
Agricultural chemicals									
Urea <u>201/</u>	100,000	7.5	Belgium	SBA ECOC-Rust	Kazincbarcika	1963	1966	N.A.	The price also includes ammonia and synthesis gas installations. A Netherlands process (Stam-carbon) is to be used for making urea.

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Table 9  
Selected Contracts for the Purchase of Chemical Equipment and Technology  
by Hungary from the Free World  
1957 Through Mid-1963  
(Continued)

Type of Plant	Production Capacity (Metric Tons Annually Unless Otherwise Indicated)	Price (Million Current US \$)	Exporter		Plant Site	Contract Date	Completion		Comments
			Country	Short Title of Firm			Scheduled	Actual	
Rubber products									
Tires 202/	N.A.	5.3	West Germany	Krupp	Budapest	Before 1962	1963	N.A.	Equipment to expand existing motor vehicle tire plant.
Other chemicals									
Caustic soda	11,000		France	Krebs	Berente Budapest	1960	1962	1963	One electrolytic plant for each location. The Berente plant is to provide chlorine for the polyvinyl chloride instal- lation there.
Chlorine	10,000	3	France	Krebs	Berente Budapest	1960	1962	1963	
Hydrogen 203/	About 1.9 million cubic meters		France	Krebs	Berente Budapest	1960	1962	1963	
Argon 204/	150,000 cubic meters	0.25	West Germany	Messer	Pethurdo	1959	N.A.	1960	Equipment.

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Table 10

Selected Contract for the Purchase of Chemical Equipment and Technology  
by Bulgaria from the Free World  
1957 Through Mid-1963

Type of Plant	Production Capacity (Metric Tons Annually)	Price (Million Current US \$)	Exporter		Plant Site	Contract	Date		Comment
			Country	Short Title of Firm			Completion Scheduled	Actual	
Other chemicals									
Acetylene 205/	About 12,000	N.A.	West Germany	Chemiebau Zieren Unde	Reka Devnya	About 1960	1962	1963	The acetylene is to be made from calcium chloride and is to be used in the manufacture of polyvinyl chloride.

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